EFFECT OF MARKET MAKER LIQUIDITY DIMENSIONS ON THE USE OF FINANCIAL DERIVATIVES IN INTEREST RATE RISK MANAGEMENT AMONG COMMERCIAL BANKS IN KENYA

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ABSTRACT

The prime objective of this research was to establish the effect of market maker liquidity dimensions on the use of financial derivatives parameters in interest rate risk management among commercial banks in Kenya. In order to request information, this research incorporated a descriptive research design. The study gathered data from 108 market makers from 39 commercial banks using email or drop - and - pick method questionnaires. Employing the use of statistical package (SPSS version 21), the analysis of data was undertaken using descriptive (percentages, frequencies and means) as well as inferential statistics for instance Pearson correlation and also regression analysis towards the determination of the relationship connecting the variables (that is the independent and dependent variables). Based on the study's findings, it is clear that in managing interest rate risk using financial derivatives, market resilience and market breadth were more important. According to the study, market immediacy and interest rate risk management using financial derivatives, were positively associated. The depth and breadth of the market have a positive and significant effect on the management of interest rate risks using financial Derivatives. Market resiliency was found to have an insignificant positive effect on the use of financial Derivatives on interest rate risk management. The study also reveals a positive correlation between market tightness and risk management of interest rates using financial derivatives. The study recommends that Kenya's commercial banks should increase their active participation in the market for interest rate derivatives as the results of the study have shown a huge presence of market makers. The government should consider strengthening the market

makers system in the country. The study also recommends that market manufacturers in commercial banks need to increase the use electronic trading platforms such as Bloomberg and Citivelocity to provide core services to support the real economy.

Key Words***: Market Immediacy, Market Depth, Market Breadth, Market Resiliency, Market Tightness, Trading Platforms, Interest Rate Risk Management and Financial Derivatives***

Introduction

Together with extensive financial volatility that occurs in the form of a high - frequency currency crisis, the globalization phenomenon has continuously upset the various economies in the world, which are large developing economies and transition economies. According to Zekos (2005), increased globalization affects economies in various ways. These include increased trade in services and merchandise, product and technology licensing, foreign direct investment, and a broader portfolio of international investment. In the past, investment banks relied predominantly on "traditional risk management" to manage their risk (Barton, Shenkir & Walker, 2002). This approach, however, has a limited capability, that is explained by Hoyt et al (2008), which has already given room for the full exploitation of new trading platform technology. More so, the concept of 'traditional risk management' lacks complete integration, which is requisite for many financial institutions.

Statement of the Problem

The fear of a repeat of the global economic crisis in 2008, which led to the collapse of several financial institutions, makes commercial banks see the need of adopting appropriate strategies in managing interest rate risk (Ngalawa & Ngare, 2014). Moreover, little data on the interest rate risk for banks is available. While there are many market liquidity studies in Kenya's commercial banks, there is limited research on the dimensions of individual market liquidity and their impact on interest rate risk management. The dimensions of market liquidity concerned include immediacy, depth, breadth, tightness and resilience. In the advent of globalization and technological shift, witnessing the era of electronic trading platforms, these market liquidity dimensions have been reported to affect the use of financial derivatives to manage interest rate risk in financial institutions around the globe. However, in the case of commercial banks in Kenya, scanty information available makes it difficult to draw conclusions as to the effect of these market liquidity dimensions on the management of interest rate risk using financial derivatives. The Central Bank of Kenya's Monetary Policy Committee (2012) Bi - Annual Report revealed that the rise in short - term interest rates was transmitted to the interest rates of commercial banks due to tight liquidity conditions. The average commercial banks' lending rates increased from a maximum interest rate of 14 per cent for most of the year, from highs of up to 25 per cent before the rates cap (Mwaniki, 2017). Commercial Banks in the bond market are exposed to market risk (Association Cambiste Internationale Singapore, 2010). It is not clear that derivatives are used in emerging markets on the Treasury bond market. The risks on the bond market in Kenya are on the rise as evidenced by the banks' decline in profit. This is due to sharp increase in interest rates as a result of revaluation of the trading book thereby causing mark-to-market unrealized losses in the bond trading portfolio and derivatives (Standard Chartered Bank, 2011; National Bank of Kenya, 2011).

Past studies reveal gaps in the utilization of subsidiaries to support financing cost hazard over the world. Dhanani *et al* (2010) analyzed the management practices related to interest rate risk of UK organizations. In particular, the study examined five theories that have been advanced in the

literature to explain why companies hedge: tax and regulatory arbitrage; under-investment, volatility of earnings and future planning; financial distress; managerial self-interest; and economies of scale. The research findings confirmed that all five theories of financial risk management have some support in practice. Ameer (2010) documents determinants of corporate hedging practices in Malaysia and found out that only a few listed Malaysian firms have appropriate understanding of the derivatives instruments to mitigate risks. Ngugi *et al* (2013) points out to the factors influencing development of financial derivatives markets in Kenya. Okumu (2013) conducted a research on impact of microstructure changes on market efficiency at the Nairobi Securities Exchange focusing on market efficiency before and after market automation. While these studies address broadly the prevalence of use of derivatives and the impact of market microstructure in the world there exists a gap on the existing literature specifically focusing on market liquidity dimensions' effect on in the Interest Rate Risk management using Financial Derivatives in Kenya. According to an outlook of Capital Markets in Kenya (2012/2013), Kenya through Vision 2030, is geared to become an international financial center and to achieve this goal deepening of the bond market provides opportunities for investment in Kenya to introduce new Trading Platforms. It remains unclear how market immediacy, depth, breadth and resilience affect Interest Rate Risk management using Financial Derivatives in Kenya given the existence of electronic trading platforms.

Research Objective

The general objective of the study was to examine the effect of market maker liquidity dimensions on the use of financial derivatives in interest rate risk management among commercial banks in Kenya.

Research Hypothesis

H_{01}: Market Immediacy does not have a significant effect on the use of financial derivatives in interest rate risk management using Financial Derivatives in commercial banks.

H_{02}: Market depth does not have a significant financial derivatives effect with management of interest rate risk in Kenyan commercial banks.

H_{03}: Market breadth lacks any significant financial derivatives use effect in management of interest rate risk in Kenyan commercial banks.

H_{04}: Market resiliency lacks any significant financial derivatives use effect in management of interest rate risk in Kenyan commercial banks.

H_{05}: Market tightness lacks any significant financial derivatives use effect in management of interest rate risk in Kenyan commercial banks.

Literature Review

Theoretical Review

Transaction Cost Theory

Engle and Lange (1997) propose the theory of transaction costs as to whether a market with sound liquidity should be a zero - cost market for transaction execution. In fact, the low transaction - cost market is considered liquid, while the high transaction - cost market is considered illiquid. Grossman and Miller (1988) come up with immediacy, which indicates that liquidity refers to any scale transactions that can be executed immediately at the market price expected. Black (1986) characterizes the market with good liquidity as follows: quotes of bid and ask always exist; meanwhile, the bid-ask spread is small enough to allow the immediate

execution of small-amount trades; and the market price is slightly influenced large-amount transactions can be realized at a price close to an average market price within a certain period. For Glosten (1987), the liquidity of the market is the ability to execute transactions immediately while keeping prices dramatically from fluctuating. The theory is relevant in that interest rates are a function of transaction costs and it is therefore necessary to manage those costs.

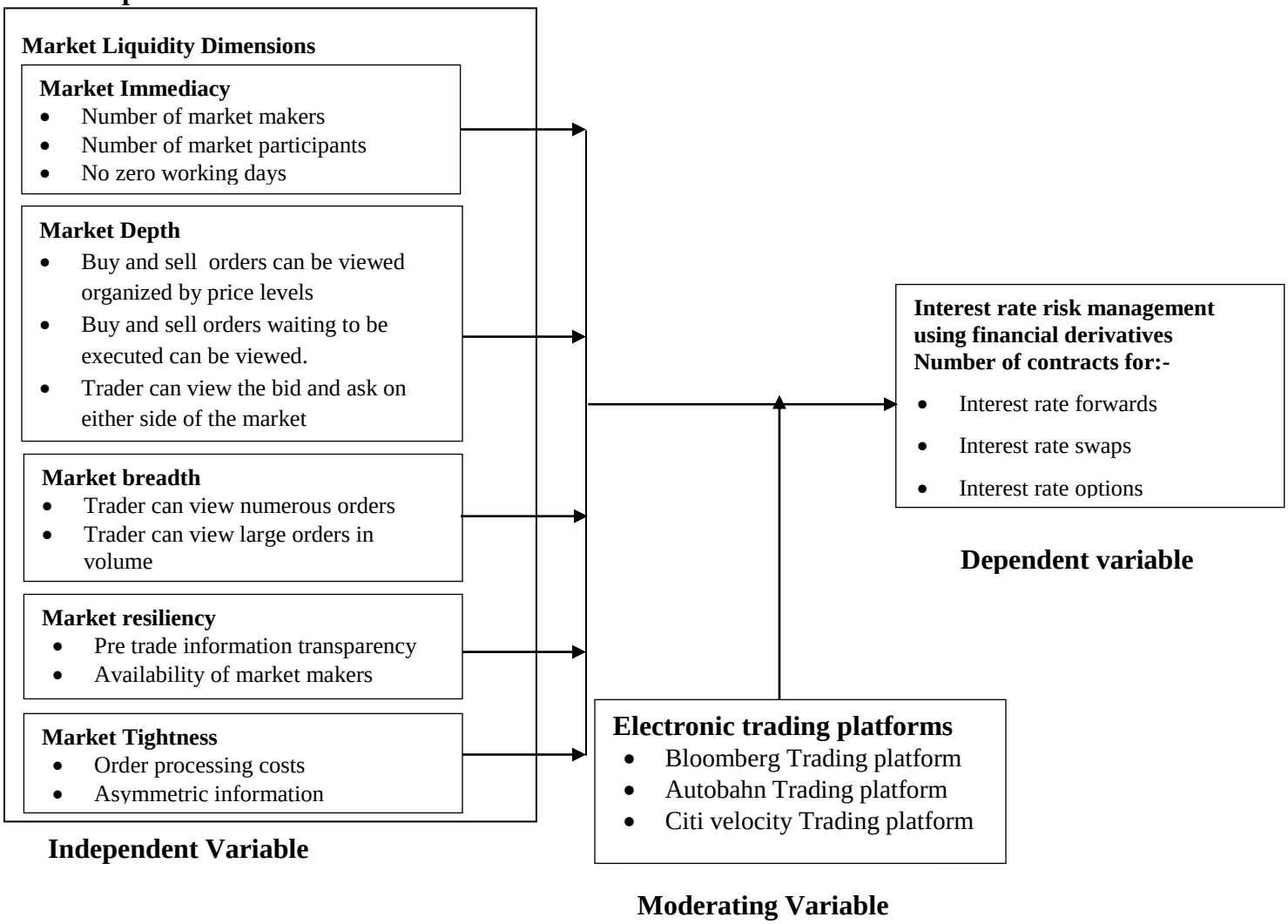
Information based model (Copeland and Galai , 1983)

Information based model was developed by Copeland and Galai in 1983. The model has an important role for information concerning the development of the bid/ask spread. The basis of Copeland & Galai (1983) model is on the concept of information costs and analyzes the market maker's one-time price-setting problem dealing with informed traders and uninformed traders. This model reveals the bid/ask spread in a monopoly situation for the market maker and in a competitive market situation. A market maker's main objective is to maximize his profits, which are the outcome of the bid and ask price setting. Besides, the bid or ask spread will occasion market marker revenue from engaging with liquidity-motivated traders while conversely, due to the fact that he also deals with informed traders, he will encounter losses.

Equilibrium Theory

The theory dates to the 1870s, particularly the work of French economist Léon Walrasin his pioneering 1874 work Elements of Pure Economics (Leon, 1974). According to the equilibrium theory, liquidity provider could mean dealer, specialist, investor, or even financial institution, all of which are considered market makers. Market makers engage in trade activity with investors as well as supply liquidity through placing limit orders or closing all transactions. As a result, market makers suffer losses because of opportunity costs, search costs, and inventory. These costs may be dismissed as less significant in normal times although they potentially lead to financial crises in the presence of information treatment and/or order-processing costs; the (unique) equilibrium price process is characterized by stochastic volatility. Meantime, investors post market orders and also face increased trading losses in terms of higher bid–ask spreads.

Conceptual Framework



Research Methodology

The study adopted a descriptive research design and targeted 168 market makers spread across the 44 commercial banks in Kenya. The study adopted Mugenda (2008) sampling formula to derive a sample of 39 commercial banks and 117 market makers comprising of three respondents from each commercial bank namely the treasurer, senior dealer and dealers. The study adopted questionnaires to collect quantitative data. Upon completion of the data collection exercise, all completed questionnaires were assembled, coded, summarized, entered into the computer; and analyzed using the statistical package for social science (SPSS) version 21.0. The data was analyzed using descriptive and inferential statistics. Descriptive statistics include percentages, frequency tables, means, and standard deviations. The study applied inferential statistics by

conducting ANOVA, regression, B- coefficient and correlation analysis. To establish the relationship between study variables, the study used a multivariate regression analysis below.

$$\mathbf{Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e}$$

Where: Y=Interest rate risk management using financial derivatives, X_1 = Market immediacy, X_2=Market depth, X_3 =Market breadth, X_4 =Market resiliency, X_5 =Market Tightness, e= Error term, α= constant, and β=coefficient of independent variables. Diagnostic tests were conducted to ensure adherence to assumptions of ordinary least square regression model.

Results

In this study, the researcher administered a total of 117 questionnaires. A total of 108 questionnaires were filled and returned. This represented a response rate of 92.3%. The response rate fit with Kothari's argument (2004) that for a descriptive study a response rate of 50% or more is adequate.

Descriptive Results

The respondents were asked to indicate their level of agreement or disagreement with statements on all the study variables. The results were rated on a five point Likert scale ranging from strongly disagrees to strongly agree. A mean response was used to establish the score. Standard deviation was also established to show the variation in the responses. The results are discussed per objective as indicated.

Market Immediacy

The respondents were requested to indicate their level of agreement or disagreement with statement concerning market immediacy. The results are as presented in Table 1.

Table 1: Descriptive results for Market Immediacy – Interest rate forwards

	N	Mean	Std. Dev	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Interest rate forwards Market has a large number of market makers.	108	3.4352	.91991	-.613	.233	-.664	.461
Interest rate forwards Market has many market participants.	108	3.3519	.98886	-.464	.233	-1.132	.461
In the Interest rate forwards Market we work continuously without any break	108	3.4074	.96709	-.585	.233	-.939	.461
Quotes are available on the Interest rate forwards Market	108	3.4259	1.01580	-.558	.233	-.831	.461

The results in Table 1 show that the statement implying that Interest rate forwards Market has a large number of market makers recorded a mean score of 3.4352. This score was higher than the neutral mean score of 3.0. This implied that on average most of the market makers felt that interest rate forwards market has a large number of market makers. The skewness was = -0.413 with a standard error of 0.461, giving a value for skewness of -0.413 /0.461 = -0.89587. Kurtosis is -0.664 with a standard error of 0.293, giving a value of -0.613/0.461 = -1.329718. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption

of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. The study also found that the statement stating that interest rate forwards market has many market participants recorded a mean score of 3.3519. This score was higher than the neutral mean score of 3.0. This implied that according to most of the market makers, interest rate forwards market has many market participants. The skewness was = -0.464 with a standard error of 0.461, giving a value for skewness of -0.464 /0.461 = -1.0065. Kurtosis is -1.132 with a standard error of 0.461, giving a value of -1.132/0.461 = -2.45553. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. The market makers play an important role in the secondary market as catalysts, particularly for enhancing stock liquidity and, therefore, for promoting long-term growth in the market. According to Hill (2018), they facilitate a smooth flow of the financial markets. The statement implying that in the interest rate forwards market, the market markers worked continuously without any break recorded a mean score of 3.4074. This score was higher than the neutral mean score of 3.0. The implication was that the flow of work was neither high nor low. Thus showing that the interest rate forwards market was not much volume of work. This was worrisome, given that as Kenton (2018) states, the market maker's commitments include continuously quoting prices at which it will buy or bid, and sell or ask for securities. The statement suggesting that Quotes are available on the interest rate forwards market recorded a mean score of 3.4259. This mean score value was higher than the neutral mean score value of 3.0. This implied that according to most of the market makers, quotes were available on the interest rate forwards market. The usefulness and available of quotes cannot be ignored. Kenton (2018) asserted that for a quote for specific stock provides information, such as its bid and ask price, last-traded price and volume traded. For all the items the skewness value was between -0.613 and -0.464. When divided by the standard error of 0.461, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.132 and –0.664. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Table 2: Descriptive results for Market Immediacy – Interest Rate Swaps

	N	Mean	Std. Dev	Skewness		Kurtosis	
			Statistic	Stat	Std. Error	Stat	Std. Error
Interest rate swaps Market has a large number of market makers.	108	3.4815	.99983	-.520	.233	-.846	.461
Interest rate swaps Market has many market participants.	108	3.2778	.94556	-.383	.233	-1.146	.461
In the Interest rate swaps Market we work continuously without any break	108	3.5278	1.01814	-.564	.233	-.812	.461
Quotes are available on the Interest rate swaps Market	108	3.4352	.90969	-.829	.233	-.682	.461

The interpretation for standard deviation was that a value above 0.5 is considered high, a large variation in the responses. The findings in Table 2 show that the statement implying that interest rate swaps market has a large number of market makers recorded a mean score of 3.7315. This mean score value was higher than the neutral mean score value of 3.0. This implied that according to most of the market makers there was a large number of market makers in interest rate swaps market. The statement implying that the interest rate swaps market has many market

participants recorded a mean score of 3.2778. This mean score value was higher than the neutral mean score value of 3.0. The implication was that there were many market participants in the interest rate swaps market. The statement implying that market makers work continuously without any break in the Interest rate swaps market recorded a mean score of 3.5278. This score was higher than the neutral score at 3.0. This implies that according to majority of the market makers did work continuously in the interest rate swaps market. For all the items the skewness value was between -0.829 and -0.383. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.146 and -0.682. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Table 3: Descriptive results for Market Immediacy – Interest Rate Options

Interest rate options Market	N	Mean	Std. Dev	Skewness		Kurtosis	
			Statistic	Statistic	Std. Error	Statistic	Std. Error
Has a large number of market makers.	108	3.3704	.99148	-.512	.233	-1.112	.461
Has many market participants.	108	3.4074	.96709	-.585	.233	-.939	.461
We work continuously without any break	108	3.3519	.98886	-.464	.233	-1.132	.461
Quotes are available on the Interest rate options Market	108	3.4074	.96709	-.585	.233	-.939	.461

The interpretation for standard deviation was that a value above 0.5 is considered high, a large variation in the responses. The findings in Table 3 show that the statement implying that interest rate options market has a large number of market makers recorded a mean score of 3.3704. This score was higher than the neutral score at 3.0. This implied that on average most of the market makers felt that interest rate forwards market has a large number of market makers. The statement implying that Interest rate options market has many market participants recorded a mean score of 3.4074. This score was higher than the neutral score at 3.0. This implied that according to most of the market makers, interest rate options market has many market participants. A mean score of 3.3519 was recorded in the statement that market makers work continuously without any break in the interest rate options market. This mean score was above the 3.0 neutral score. The implication was that they continuously worked on the interest rate options market, according to market makers.

The findings in Table 3 revealed that the statement showing that access to both buy and sell orders waiting to be executed by participants on the interest rate option market recorded an average score of 3.4074. The recorded mean score was higher than the neutral value at 3.0. This implied that quotes are available on the interest rate options market according to most of the market makers. For all the items the skewness value was between -0.585 and -0.464. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.132 and -0.939. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. The finding are in line with the argument by PricewaterhouseCoopers (2015) who indicated that

the proportion of zero working days as a percentage of days on which clearing exists remained around 70%. Quotes are available on the Interest rate forwards, swaps and options Market, interest rate swaps market has a large number of market makers, interest rate swaps, options and forwards market has many market participants. A study by Federal Reserve Bank New York (2012) on an analysis of OTC interest rate Derivatives transactions with a focus on implications for public reporting found out that the market composition and trading relationship of interest rate derivatives comprised trading activity isolated among market participants. These participants traded with more than one dealer mostly with several dealers which is similar to the findings on market participants of this study.

Market depth

The respondents were requested to indicate their level of agreement or disagreement with statement concerning market depth. The results are as presented in Table 4.

Table 4: Descriptive results for Market Depth

	N	Mean	Std. Dev	Skewness		Kurtosis	
			Stat	Stat	Std. Error	Statistic	Std. Error
On the interest rate forwards market							
Participants access a list of buy and sell orders organized by price levels and updated to reflect market activity.	108	3.3241	1.00307	-.409	.233	-1.229	.461
Participants access both buy and sell orders waiting to be executed.	108	3.3519	1.10492	-.188	.233	-1.343	.461
Participant access the bid and asks on either side of the market.	108	3.2870	.92777	-.249	.233	-1.236	.461
Participants access a list of buy and sell orders organized by price levels and updated to reflect market activity.	108	3.3981	.95643	-.617	.233	-.942	.461

The findings in Table 4 show that the statement implying that on the interest rate forwards market participants access a list of buy and sell orders organized by price levels and updated to reflect market activity recorded a mean score of 3.3241. The mean score value was higher than the neutral mean score value of 3.0. This implied that according to most of the market makers market participants access a list of buy and sell orders organized by price levels and updated to reflect market activity. The statement implying that on the interest rate forwards market, participants are able to access both buy and sell orders waiting to be executed recorded a mean score of 3.3519. This means that the score value was higher than the neutral mean score value of 3.0. The implication was that participants access both buy and sell orders waiting to be executed, according to most market makers, with regards to this market. The statement asserting that on the interest rate forwards market participant access the bid and asks on either side of the market recorded a mean score of 3.2870. This value was higher than the set neutral mean score at 3.0. The implication was that according to most of the respondents (market makers), market participant access the bid and asks on either side of the market. The same arguments can be put forward in respect to the Interest Rate swap market, where the statements in Table 4 scored as follows. Market participants access a list of buy and sell orders organized by price levels and updated to reflect market activity recorded a mean score of 3.3981. Market participants access both buy and sell orders waiting to be executed, recorded a mean score of 3.1759 and Market participants' access the bid and asks on either side of the market (3.4167). All these statements

recorded a mean score above the 3.0 neutral mean score showing that most of the market makers were in agreement with the assertions of the selected dimensions of market depth. All the items recorded a skewness value between -.617 and -0.107. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.476 and -0.881. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Table 5: Descriptive results for Market Depth (Interest Rate Option Market)

	N	Mean	Std. Dev	Skewness		Kurtosis	
			Stat	Stat	Std. Error	Stat	Std. Error
Participants' access a list of buy and sell orders organized by price levels and updated to reflect market activity.	108	3.3148	.93377	-.392	.233	-.985	.461
Participants' access both buy and sell orders waiting to be executed.	108	3.1944	1.02728	-.190	.233	-1.488	.461
Participant's access the bid and asks on either side of the market.	108	3.3704	.93321	-.598	.233	-.937	.461

The interpretation for standard deviation was that a value above 0.5 is considered high, a large variation in the responses. The findings in Table 5 show that the statement implying that on the interest rate option market participants' access a list of buy and sell orders organized by price levels and updated to reflect market activity, recorded a mean score of 3.1944. This score was higher than the neutral score at 3.0. This implied that on average most of the market makers on this market, felt that participants' access a list of buy and sell orders organized by price levels and updated to reflect market activity. The statement implying that on the interest rate option market participants' access both buy and sell orders waiting to be executed, recorded a mean score of 3.4074. This score was higher than the neutral score at 3.0. This implied that according to the market makers, participants' access both buy and sell orders waiting to be executed. The statement implying that on the interest rate option market participant's access the bid and asks on either side of the market recorded a mean score of 3.3704. This mean score was higher than the neutral score at 3.0. The implication was that according to the market makers, participant's access the bid and asks on either side of the market. All the items recorded a skewness value between -0.598 and -0.190. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.488 and -0.985. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. The study findings in Table 5 indicated that on the interest rate forwards and swaps market participant's access both buy and sell orders waiting to be executed. Furthermore, on the interest rate forwards and options, market participants access the bid and ask on either side of the market. Majority of the respondents disagreed that on the interest rate option market participants' access a list of buy and sell orders organized by price levels and updated to reflect market activity. Descriptive results for Market Depth (Interest Rate Option Market) show that all indicators had a value slightly higher than the 3.0 neutral value, with distribution of scores within the normal range. This can be construed to mean that the market in commercial banks had aspects that made interest rate management tenable.

Market Breadth

The respondents were requested to indicate their level of agreement or disagreement with statement concerning market breadth. The results are as presented in Table 6.

Table 6: Descriptive results for Market Breadth

	N	Mean	Std. Dev	Skewness		Kurtosis	
			Statistic	Statistic	Std. Error	Statistic	Std. Error
Interest rate forward Market has numerous orders	108	3.0278	.99022	.120	.233	-1.409	.461
Interest rate forward Market has large in volume orders.	108	3.1667	.90171	-.104	.233	-.981	.461
Interest rate swap Market has numerous orders.	108	3.2407	.90554	-.268	.233	-.980	.461
Interest rate swap Market has large in volume orders.	108	2.9907	1.05454	-.079	.233	-1.179	.461
Interest rate options Market has numerous orders.	108	3.2593	.92089	-.323	.233	-1.047	.461
Interest rate options Market has large in volume orders.	108	3.2222	.93061	-.248	.233	-1.123	.461

The findings in Table 6 show that the statements relating to the Interest rate forward Market recorded the following mean scores. Interest rate forward Market has numerous orders (3.0278), and Interest rate forward Market has large in volume orders (3.1667). All the indicators had a slightly higher value than the neutral mean score at 3.0. The implication is that according to most of the market makers the interest rate forward market has numerous orders and large in volume orders. The findings in respect to the interest rate swap market shows that the mean scores were as follows. Interest rate swap market has numerous orders (3.2407), a value higher than the neutral mean score at 3.0. Interest rate swap market has large in volume orders (2.9907), a value lower than the neutral mean score at 3.0. This market had numerous orders and not so large in volume orders. The findings in respect to the interest rate options market shows that the mean scores were as follows. Interest rate options Market has numerous orders (3.2593) and Interest rate options Market has large in volume orders (3.2222). All the indicators had a slightly higher value than the neutral mean score at 3.0. This implied that according to most of the respondents (market makers), the interest rate options market has numerous orders and large in volume orders. All the items recorded a skewness value between -0.323 and -0.079. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.409 and -0.980. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Market Resiliency

The respondents were also requested to indicate their level of agreement or disagreement with statement concerning market resiliency. The results are as presented in Table 7

Table 7: Descriptive results for Market resiliency

	N	Mean	Std. Dev	Skewness		Kurtosis	
			Statistic	Stat	Std. Err	Stat	Std. Error
Market participants' access published quotes and orders for interest rate forwards.	108	3.2130	1.03265	-.181	.233	-1.438	.461
Buyers and sellers are present in the interest rate forwards.	108	3.5093	1.08942	-.378	.233	-1.103	.461
Buyers and sellers are present in interest rate swaps market.	108	3.3148	.94373	-.333	.233	-.977	.461
Market participants' access published quotes and orders in interest rate swaps market.	108	3.2593	.98939	-.249	.233	-1.234	.461
There is presence of buyers and sellers of interest rate options in the market.	108	3.4722	1.05422	-.413	.233	-1.049	.461
Published quotes and orders can be accessed by market participants in interest rate options	108	3.3611	.99961	-.438	.233	-1.127	.461
Buyers and sellers are present in interest rate options market.	108	3.3148	.94373	-.265	.233	-1.220	.461

The findings in Table 8 shows that the statements relating to the market resiliency recorded the following mean scores. The findings show that the statements implying that market participants' access published quotes and orders recorded mean scores above 3.0 in the three markets (interest rate forwards, interest rate swaps market and interest rate options). The same was the case with the presence of buyers and sellers in three markets. The implication is that according to most of the market makers, had access to published quotes and interest rate forward orders by market participants, access to published quotes and interest rate options orders, published quotes and interest rate swap orders.. Most of the market makers agreed that there is presence of buyers and sellers of interest rate swaps, and presence of buyers and sellers of interest rate options in the market. In addition, all the items recorded a skewness value between -0.438 and -0.181. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.438 and -0.977. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. Therefore, the distribution was normal.

Market Tightness

The respondents were also requested to indicate their level of agreement or disagreement with statement concerning market tightness. The results are as presented in Table 9.

Table 9: Descriptive results for Market Tightness

	N	Mean	Std. Dev	Skewness		Kurtosis	
			Stat	Stat	Std. Error	Stat	Std. Error
Interest Rate Forwards Market							
Order processing costs are a source of bid-ask spread	108	3.620	.78201	-1.246	.233	-1.015	.461
Inventory costs are a source of the bid-ask spread	108	3.796	.72032	-1.507	.233	-1.801	.461
Bid-ask spread is influenced by asymmetric information	108	3.435	.93001	-.766	.233	-.752	.461
Interest Rate Swap Market							
Order processing costs is the only source of the bid-ask spread	108	3.194	.93187	-.400	.233	-1.117	.461
Inventory costs is the sole source of the bid-ask spread	108	3.232	.90281	-.478	.233	-.901	.461
Bid-ask spread is influenced by asymmetric information	108	3.194	.90128	-.397	.233	-.946	.461

Table 9 shows that the statements relating to the market tightness on the interest rate forwards market recorded the following mean scores. Source of the bid-ask spread is only order processing costs (3.620) inventory costs are the source of the spread bid-ask spread (3.796), and asymmetric information is the sole source of the bid-ask spread (3.435). All the three indicators had a higher value than the neutral mean score at 3.0. The implication is that according to most of the market makers order processing costs, asymmetric information and inventory costs were all sources of the spread bid-ask spread in commercial banks in Kenya. The findings in Table 9 show that the statements relating to the market tightness on the interest rate swap market recorded the following mean scores. Order processing costs is the only source of the bid-ask spread (3.194), inventory costs is the sole source of the bid-ask spread (3.232) and bid-ask spread is influenced by asymmetric information (3.194). All the three indicators had a higher value than the neutral mean score at 3.0. The implication is that according to most of the market makers order processing costs, asymmetric information and inventory costs were all sources of the spread bid-ask spread in commercial banks in Kenya.

Table 1: Descriptive results for Market Tightness (Interest Rate Option Market)

	N	Mean	Std. Dev	Skewness		Kurtosis	
			Stat	Stat	Std. Error	Stat	Std. Error
Source of the bid-ask spread is only order processing costs	108	3.1759	.92553	-.360	.233	-1.106	.461
Inventory cost is the sole source of the bid-ask spread	108	3.3426	.83344	-.719	.233	-.195	.461
Bid-ask spread is influenced by asymmetric information	108	3.4444	.81267	-.882	.233	-.176	.461

The findings in Table 10 show that the statements relating to the market tightness on the Interest Rate Option Market recorded the following mean scores. Order processing costs is the only source of the bid-ask spread (3.1759), inventory costs is the sole source of the bid-ask spread (3.3426) and bid-ask spread is influenced by asymmetric information (3.4444). All the three indicators had a higher value than the

neutral mean score at 3.0. The implication is that according to most of the market makers order processing costs, asymmetric information and inventory costs were all sources of the spread bid-ask spread in commercial banks in Kenya. All the items recorded a skewness value between -1.507 and -0.360. When the skewness value is divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.801 and -0.176. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0. Therefore, the distribution was a normal distribution.

Financial Derivatives Used to Manage Interest Rate Risk

The dependent variable of the study was financial derivatives used to manage interest rate risk. The respondents were requested to rate statements on financial derivatives used to manage interest rate risk on a scale of 1 to 5. The descriptive results are presented in Table 11.

Table 2: Descriptive results of Financial Derivatives Used to Manage Interest Rate Risk

Interest rate swaps	N	Mean	Std. Dev	Skewness		Kurtosis	
			Statistic	Stat	Std. Error	Stat	Std. Error
The bank uses financial derivatives to Swap from fixed rate to floating rate debt	108	3.2778	1.01238	-.199	.233	-1.216	.461
The bank uses financial derivatives to swap from floating rate to fixed rate debt	108	3.3148	.93377	-.462	.233	-1.042	.461
The bank uses financial derivatives to Fix in advance the rate (spread) on new debt	108	3.2963	.93987	-.354	.233	-1.035	.461

The findings in Table 11 shows that the statements relating to financial derivatives used to manage interest rate risk recorded the following mean scores. The bank uses financial derivatives to swap from fixed rate to floating rate debt (3.2778), the bank uses financial derivatives to swap from floating rate to fixed rate debt (3.3148), and the bank uses financial derivatives to fix in advance the rate (spread) on new debt (3.2963). All the items had a slightly higher value than the neutral mean score at 3.0. This shows that most of the respondents agreed that Financial Derivatives were used to swap from fixed rate to floating rate debt, to swap from floating rate to fixed rate debt and to fix in advance the rate (spread) on new debt. All the items recorded a skewness value between -0.462 and -0.199. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.216 and -1.035. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Table 3: Descriptive results of Financial Derivatives Used to Manage Interest Rate Risk

	N	Mean	Std. Dev	Skewness		Kurtosis	
Interest Rate Options			Stat	Stat	Std. Error	Stat	Std. Error
The bank uses interest rate options that are exercised only on the expiry date of the	108	3.4074	.89690	-.667	.233	-.678	.461
The bank uses interest rate options that the purchaser has the right to exercise the option at any time before and on the expiry date of the contract.	108	3.4259	.93931	-.471	.233	-.731	.461

The bank uses interest rate options that are exercised only on the pre-specified dates for the duration of the contract.	108	3.2685	.93335	-.353	.233	-1.099	.461

Table 12 shows that the statements showing the use of interest rate options to manage interest rate risk recorded the following mean scores. The bank uses interest rate options that are exercised only on the expiry date of the contract (3.4074). The statement stating that the bank uses interest rate options that the purchaser has the right to exercise the option at any time before and on the expiry date of the contract recorded a mean score of 3.4259. The statement implying that the bank uses interest rate options that are exercised only on the pre-specified dates for the duration of the contract recorded a mean score of 3.2685. All the items had a slightly higher value than the neutral mean score at 3.0. This implied that most of the market makers observed that the bank was using interest rate options that are exercised only on the expiry date of the contract; and that the purchaser has the right to exercise the option at any time before and on the expiry date of the contract. Most of the market makers had observed that the use of interest rate options that are exercised only on the pre-specified dates for the duration of the contract. All the items recorded a skewness value between -0.667 and -0.353. When divided by the standard error of 0.233, we obtain a value less than 2.0. This is also the case with Kurtosis, whose scores range between -1.099 and -0.731. When divided by the standard error of 0.461, we obtain a value less than 2.0. The rule is that if either or both the skewness and kurtosis of these values is 2 or larger, then the assumption of normality is rejected. In this case, the assumption of normality is accepted as the largest negative skewness is less than a value of 2.0.

Descriptive Statistics for Electronic Trading Platforms

This section presents the descriptive statistics related to respondents understanding and perception of electronic trading platforms as a moderating variable in the relationship between market liquidity and the management of interest rate risk using financial derivatives.

Awareness of the functioning of Electronic Trading Platforms

The respondents were asked to indicate whether or not they were aware of the three main electronic platforms: Bloomberg, Citivelocity and Autobahn electronic trading platforms.

Table 4: Awareness of the functioning of Electronic Trading Platforms

Trading Platform	**Yes**		**No**		**Total %**
	Frequency	Percentage	Frequency	Percentage	
Bloomberg	98	91	10	9	100
Citivelocity	91	84	17	16	100
Autobahn	96	89	12	11	100

The findings in Table 13 show that majority of the respondents were aware of the functioning of Electronic Trading Platforms. Bloomberg registered highest level of awareness among the market makers followed closely by the awareness levels of Citivelocity and Autobahn electronic trading platforms.

Experience of Market Makers on the Moderating Aspect of electronic trading platforms

The respondents were asked to indicate whether or not electronic trading platforms influenced the effectiveness of market liquidity in the management of interest rate risk using financial derivatives. The response was as provided in Table 14.

Table 5: Electronic Trading Platforms affects the Efficacy of Market Liquidity

Response	Frequency	Percentage
Yes	101	94
No	7	6%
Total	108	100%

The findings in Table 14 shows that according to majority of the market makers (94%), electronic trading platforms influenced the effectiveness of market liquidity in the management of interest rate risk using financial derivatives. This implied that the type of electronic trading platform determined how market liquidity dimensions were influencing the management of interest rate risk using financial derivatives.

Correlations

Correlation between Market Immediacy and Interest Rate risk management using Financial Derivatives

Presented in Table 15, are the results for Pearson's correlations between Market Immediacy and interest rate risk management using financial derivatives.

Table 6: Correlation between Market Immediacy and Interest Rate risk management

		Market Immediacy	Interest Rate risk management using Financial Derivatives
Market Immediacy	Pearson Correlation	1	.216**
	Sig. (2-tailed)		.001
	N	108	108
Interest Rate risk management using Financial Derivatives	Pearson Correlation	.216**	1
	Sig. (2-tailed)	.001	
	N	108	108

*. Correlation is significant at the 0.05 level (2-tailed).

The findings in Table 15 show that the Pearson correlation results between Market Immediacy and Interest Rate risk management using financial derivatives were as follows. There was a positive correlation between market immediacy and risk management of interest rates ($r = 0.216^*$, $p = 0.001$). This demonstrates that market immediacy and interest rate risk management were associated. Given that, the p value (0.001), was less than the test significance level ($p < 0.05$), this relationship is statistically significant.

Correlation between Market Depth and Interest Rate risk management using Financial Derivatives

Table 7: Correlation Results

		Market Depth	Interest Rate risk management using Financial Derivatives
Market Depth	Pearson Correlation	1	.293**
	Sig. (2-tailed)		.002

Interest Rate risk management using Financial Derivatives	Pearson Correlation	.293**	1
	Sig. (2-tailed)	.002	
	N	108	108

*. Correlation at level 0.05 (2-tailed) is significant.

Table 16 shows a positive correlation between market depth and interest rate risk management was found (r = 0.293*, p = 0.002). This shows that market depth and interest rate risk management were associated. Given that, the p value (0.000), was less than the test significance level (p < 0.05), this relationship is statistically significant.

Correlation between Market Breadth and Interest Rate risk management using Financial Derivatives

Table 8: Correlation Results

		Market Breadth	Interest Rate risk management using Financial Derivatives
Market Breadth	Pearson Correlation	1	.370**
	Sig. (2-tailed)		.000
Interest Rate risk management using Financial Derivatives	Pearson Correlation	.370**	1
	Sig. (2-tailed)	.000	
	N	108	108

Table 17 shows a positive Pearson correlation between market breadth and interest rate risk management using financial derivatives (r = 0.370, p = 0.000). This shows that there was an association between market breadth and interest rate risk management. Given that, the p value (0.000), was less than the test significance level (p < 0.05), this relationship is statistically significant.

Correlation between Market Resiliency and Interest Rate risk management using Financial Derivatives

Table 9: Correlation Results

		Market Resiliency	Interest Rate risk management using Financial Derivatives
Market Resiliency	Pearson Correlation	1	.344**
	Sig. (2-tailed)		.000
Interest Rate risk management using Financial Derivatives	Pearson Correlation	.344**	1
	Sig. (2-tailed)	.000	
	N	108	108

The finding in Table 18 reveal that there was a positive Pearson correlation between market resiliency and interest rate risk management using financial derivatives (r = 0.344, p = 0.000). This shows that there was an association between market resiliency and interest rate risk management. Given that, the p value (0.000), was less than the test significance level (p < 0.05), this relationship is statistically significant.

Correlation between Market Tightness and Interest Rate risk management using Financial Derivatives

Table 10: Correlation Results

		Market Tightness	Interest Rate risk management using Financial Derivatives
Market Tightness	Pearson Correlation	1	.345**
	Sig. (2-tailed)		.000
Interest Rate risk management using Financial Derivatives	Pearson Correlation	.345**	1
	Sig. (2-tailed)	.000	
	N	108	108

The finding in Table 19 shows that Market Tightness and interest rate risk management using financial derivatives had a positive Pearson correlation at ($r = 0.345$, $p = 0.000$). This shows that there was an association between market resiliency and interest rate risk management. Given that, the p value (0.000), was less than the test significance level ($p < 0.05$), this relationship is statistically significant.

Correlation Results according to Electronic Trading Platforms

Table 11: Correlation Results

Classification by ETP			MI	MR	MD	MB	MT	IRRmFD
Bloomberg	IRRmFD	Pearson Correlation	.335	.680**	.534**	.581**	.512**	1
		Sig. (2-tailed)	.075	.000	.003	.001	.005	
		N	29	29	29	29	29	29
Citivelocity	IRRmFD	Pearson Correlation	.460**	.543**	.568**	.574**	.493**	1
		Sig. (2-tailed)	.005	.001	.000	.000	.003	
		N	35	35	35	35	35	35
Autobahn electronic trading platforms	IRRmFD	Pearson Correlation	-.162	-.044	-.089	.057	.098	1
		Sig. (2-tailed)	.294	.776	.565	.712	.527	
		N	44	44	44	44	44	44

MI = Market Immediacy, MR = Market Resiliency, MD = Market Depth, MB = Market Breadth, MT = Market Tightness, and IRRmFD = Interest Rate risk management using Financial Derivatives

Table 20 shows that the Pearson correlation results between market liquidity dimensions and interest rate risk management using financial derivatives in Bloomberg electronic trading platforms were as follows. The study reveals a positive Pearson correlation between interest rate risk management using financial derivatives and market immediacy ($r = 0.335$, $p = 0.075$); market resiliency and management of interest rate risk management ($r = 0.680$, $p = 0.000$); between management of interest rate risk management and market depth ($r = 0.534$, $p = 0.003$); there was positive correlation between market breadth and management of interest rate risk

management at (r = 0.581, p = 0.001); and market depth and management of interest rate risk management (r = 0.512, p = 0.005. The results show that there was a positive association between the independent variables and interest rate risk management using financial derivatives. The highest correlation was that between market resiliency and IRRmFD followed by market breadth and then, market depth. The Pearson correlation results between results between market liquidity dimensions and interest rate risk management using financial derivatives in Citivelocity electronic trading platforms were as follows. There was a positive Pearson correlation between market immediacy and management of interest rate risk (r = 0.460**, p = 0.005); market resiliency and management of interest rate risk (r = 0. 543, p =0.001); between market depth and management of interest rate risk (r = 0.568, p = 0.000), market breadth and management of interest rate risk was (r = 0.574, p = 0.000); and market depth and management of interest rate risk (r = 0.493, p = 0.003. The results show that there was a positive association between the independent variables and interest rate risk management using financial derivatives. The highest correlation was that between market breadth and IRRmFD followed by market depth and then, market resiliency.

The Pearson correlation results between results between market liquidity dimensions and interest rate risk management using financial derivatives in Autobahn electronic trading platforms were as follows. There was a negative Pearson correlation between market immediacy and management of interest rate risk (r = -0.162, p = 0.294); market resiliency and management of interest rate risk (r = -0.044, p =0.776); between market depth and management of interest rate risk (r = -0.089, p = 0.565), market breadth and management of interest rate risk was (r = 0.057, p = 0.712); and market depth and interest rate risk management using financial derivatives (r = 0.098, p = 0.527). The results show that the independent variables and interest rate risk management were positively associated. The highest correlation was that between market tightness and IRRmFD followed by market breadth and then, market resiliency.

Regression Analysis

To determine the relationship between the independent and dependent variables, multiple regression was calculated and the results are presented in this section. . The independent variables of the study were market immediacy, market resiliency, market depth, market breadth and market tightness. The dependent variable was Interest Rate risk management using Financial Derivatives.

Table 12: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
.476[a]	.226	.189	.71872	.476[a]

In the Model Summary table, the R Square value shows the amount of variance in the dependent variable that the independent variables explain. In Table 21 shows that, the independent variable of Market Tightness, Market Resiliency, Market Breadth, Market Immediacy, Market Depth accounts for 18.9 per cent of the variability in Interest Rate risk management using Financial Derivatives. The R-value (.476) is the multiple coefficients of correlation between all the independent variables entered and the dependent variable. As the number of variables increases, the Adjusted R Square adjusts for a bias. The Std. Error of the Estimate is a measure of the accuracy of the prediction.

Analysis of Variances (ANOVA)

Table 13: Analysis of Variances (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.422	5	3.084	5.971	.000[b]
	Residual	52.689	102	.517		
	Total	68.111	107			

The findings in Table 22 show a p value of 0.000. This value is less than the test significant level at 0.05 (Coefficient level). This indicates that the combined effect of all the five independent variables on the dependent variable is statistically significant. This is also confirmed by the F-test whereby the calculated F = 5.971 is less than the tabulated F (5, 102). The Beta Coefficients with respect to the relationship of the study variables are presented in Table 23.

Table 14: Beta Coefficients and Model for the Commercial Banks

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.032	.302		6.720	.000
	Market Immediacy	-.191	.127	-.216	-1.503	.136
	Market Depth	-.287	.188	-.325	-1.524	.131
	Market Breadth	.272	.126	.304	2.524	.013
	Market Resiliency	.376	.149	.454	2.659	.009
	Market Tightness	.271	.102	.289	2.161	.033

The optimal regression model therefore becomes:

Interest Rate Risk Management Using Financial Derivatives=2.032+ 3.76(Market Resiliency) + .272(Market Depth) +.271(Market Tightness) -.191(Market Immediacy) -.287 (Market Depth)

From the findings, it emerges that market resiliency has the greatest effect on Interest rate risk management using financial derivatives followed by market Depth, then market tightness. Market Immediacy and Market Depth had negative effects on Interest rate risk management.

Conclusions

The study arrived at a conclusion that that quotes are available on the Interest rate forwards, swaps and options market and that interest rate swaps market has a large number of market makers including many market participants. The study also concluded that market immediacy has a positive but insignificant effect on interest rate risk management using financial Derivatives in Kenya implying that an increase in market immediacy indicators for instance number of market makers and market participants leads to an insignificant increase in the interest rate risk management using financial Derivatives by commercial banks in Kenya. Another conclusion made by the study is that on the interest rate forwards and swaps market participant's

access both buy and sell orders waiting to be executed. Furthermore, on the interest rate forwards and options, market participants access the bid and ask on either side of the market.

The study also concluded that market depth has a positive and significant effect on the management of interest rate risk using financial Derivatives in Kenya which imply that an increase in the access of a list of buy and sell orders organized by price levels and updated to reflect market activity, access of both buy and sell orders waiting to be executed and access of the bid and asks on either side of the market positively leads to an increase in interest rate risk management using financial derivatives.

The study determined that market breadth had a great effect on the management of interest rate risk using financial derivatives in Kenya. The researcher concludes that an increase in market breadth indicators for instance volume of orders in the interest rate options, swaps and forwards market influenced in a positive way the increase in interest rate risk management using financial derivatives. On market resiliency, the study concluded that interest rate derivatives market participants' access published quotes and orders for interest rate forwards more than quotes and orders for interest rate swaps. The study also concluded that market participants' access published quotes and orders for interest rate options. Another conclusion made by the study is that market resiliency has a significant effect on interest rate risk management using financial Derivatives in Kenya implying that when there is an increase in the select market resiliency indicators there is an associated positive significant increase in the management of interest rate risk using financial derivatives. The study findings led to the conclusion makers order processing costs, asymmetric information and inventory costs were all sources of the spread bid-ask spread in commercial banks in Kenya. The study also arrived at the conclusion that market tightness in commercial banks in Kenya has a significant effect on the management of interest rate risk using financial derivatives. The three electronic trading platforms that is Bloomberg, Citivelocity and Autobahn electronic trading platforms moderates the relationship between all the market liquidity dimensions examined in this study and the use of financial derivatives in interest rate risk management.

Recommendations

The management of commercial banks should mobilize resources to raise the level of awareness of the management team and market makers on existing infrastructure for the use of financial derivatives in managing interest rate risk amidst the dynamism of market liquidity. Lack of knowledge may lead to omissions of risks that ought to be managed. The market maker system should be improved. The government should give market makers support politically, such as providing convenient source of financing, allowing short selling, motivating their enthusiasm and initiative. The findings show that almost half of the market makers show that there are not so many participants and the number is low. Considering that the number of market makers is still insufficient and thus there is also lack of diversity, it is better for the government to lower the requirement of being a market maker to improve the efficiency of trading. Commercial bank dealers who are designed to provide clients services that require principal risk taking, a function that is a vital element of market resilience during volatile events, should adopt increased use of electronic trading platforms like Bloomberg and Citivelocity in providing core services to

support the real economy. Such diversity is a necessary and welcome development, and complements the role commercial banks and bank dealers will continue to play in effective market functioning thus affecting market liquidity. The study also recommends that commercial banks in Kenya should increase their participation in the interest rate derivatives market as the study findings has indicated huge presence of market makers.

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